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## Decoding the Patterns of Human Behavior: A Locally Weighted Machine Learning Approach for Complex Human Activity Recognition

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As life expectancy rises, the elderly care sector faces a looming workforce shortage. Ambient Assisted Living (AAL) systems emerge as a promising solution, with Human Activity Recognition (HAR) as a key component. HAR's ability to automatically track activities empowers comprehensive health and well-being assessments, easing the burden on healthcare professionals. Lifelogging and home diary applications further enhance this value by providing valuable insights into daily routines.

Complex activities, however, pose a unique challenge due to their intricate semantic nature. To address this, a machine learning framework that utilizes a single accelerometer sensor to accurately predict complex human activities is proposed. The Locally Weighted Random Forest (LWRF) algorithm, with its hybrid structure and local weighting approach, proves remarkably effective, achieving 91% accuracy for HAR and 91.3% for gender recognition.

This work paves the way for embedding the proposed framework into lifelogging and home diary applications, enabling real-time monitoring of mental status and overall well-being among the elderly. As AAL systems continue to advance, their potential to transform elderly care is undeniable.

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